USING INCENTIVES AND OTHER ACTIONS TO REDUCE WATERSHED IMPACTS FROM EXISTING DEVELOPMENT.

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Abstract
Local jurisdictions must find new ways to mitigate impacts from urban development. Urban development creates a variety of negative impacts within watersheds. Impacts relating to the flow rate, volume and water quality of urban stormwater runoff are varied and sometimes difficult to remediate. While most local communities are beginning to implement post-development stormwater management requirements, many communities struggle to address impacts from existing development. Many local communities can have 80-90% of their land area already built out, which limits the overall effectiveness of new and redevelopment stormwater management requirements. Local businesses and citizens can either harm or help keep local waterways clean. They can also mitigate impacts from existing development. A combination of educational, technical assistance, and incentive programs can be used to change the behavior of businesses and citizens. Whether it is saving money, protecting the environment for future generations, gaining recognition or some other motivator for change, local jurisdictions need to create a menu of programs and incentives to gain the participation of citizens in protecting the environment. Portland, Oregon has made great strides at limiting impacts to local watersheds through creative programs such as Downspout Disconnection, Stewardship Grants, and Clean River Incentive and Discount Programs. These and other programs are leading the way to addressing and hopefully minimizing negative impacts from existing urban development.

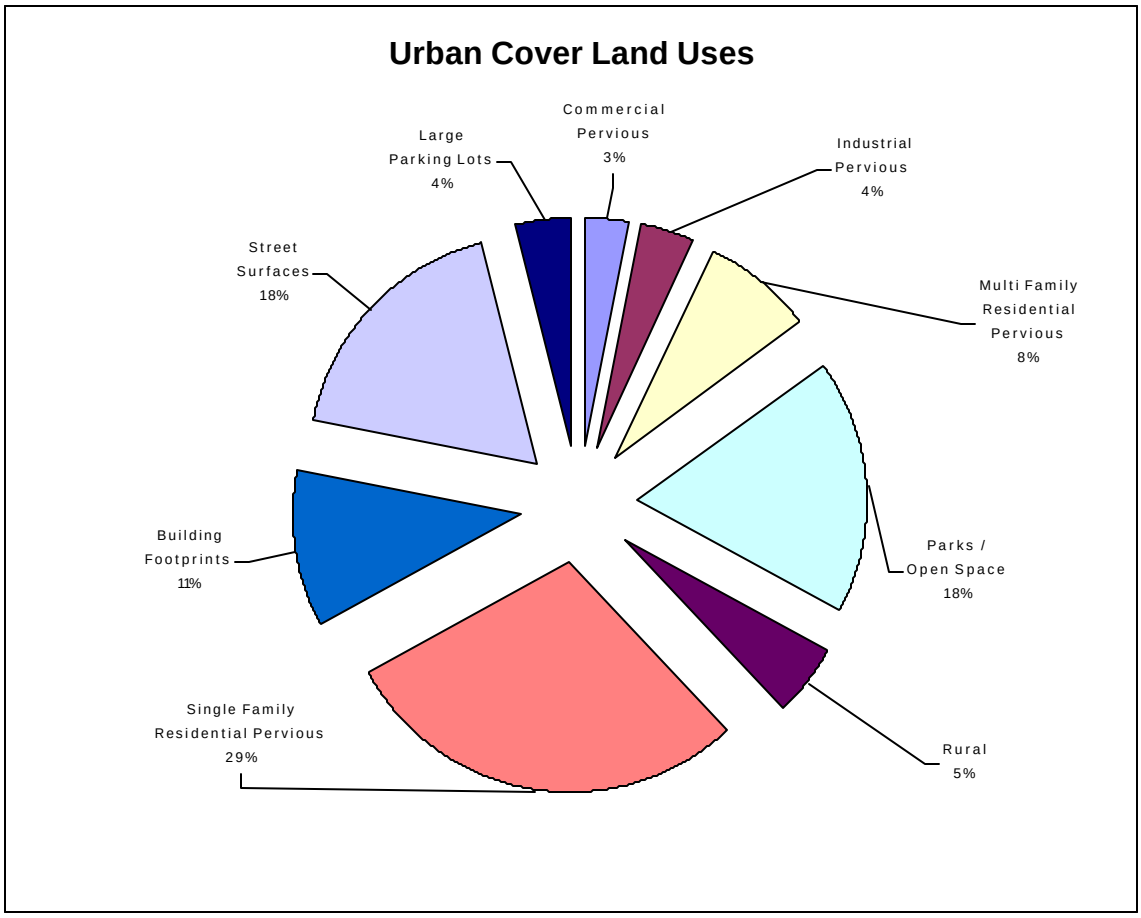
Background

Portland, Oregon is located on the northern border of the state, at the confluence of the Columbia and Willamette Rivers. Portland is home to 510,000 citizens in an area of approximately 130 square miles. There are approximately 4,000 miles of street that are drained by 800 miles of combined sewer, 400 miles of storm sewer, 129 miles of drainage ditch and over 9,000 public drainage sumps. The City of Portland, Bureau of Environmental Services (BES) operates and maintains these storm drainage systems, two sewer treatment plants, and implements water quality improvement / watershed health program efforts. The City of Portland has a Phase 1 NPDES Municipal Stormwater Permit and was recognized in 1996 as the best stormwater permit program in the nation.

Portland is located at the bottom of the Willamette River watershed – one of the few south-to-north draining rivers in the United States. The Portland urban services boundary contains four major sub-watershed drainage systems and a large number of smaller drainageways that discharge directly to the Willamette River. Almost all of those drainages are listed by the State as not meeting their designated beneficial uses. There is an EPA designated Superfund site in the Willamette channel at Portland Harbor – between river miles 9 and 4 south of the Columbia River confluence.

Portland is home to a variety of state- and federal-listed threatened and endangered species. Perhaps the most significant are the three species of salmonids that have been listed in the Willamette watershed over the last three years. These fish species are directly impacted by citizen behavior and the runoff from existing development[1].

Impervious surfaces from existing development account for approximately 33% of Portland's total land area or just over 43 square miles of paved and other hard surfaces (see Figure No.1 below for land coverage breakdown). Of the 33% of the urban area that is impervious, 22% is paved areas that support car usage. Pervious housing areas only account for 37% and 7% pervious industrial and commercial areas. Open space and rural land use areas make up the remaining 23% of total land coverage[2].



(Figure No. 1) City of Portland, Environmental Services GIS Zoning Layer. Information built from local zoning ordinances and the Metropolitan Service District 2040 Urban Growth Boundary Framework Plan.

Problem

Impervious surfaces have a variety of negative impacts on local watersheds. Besides significantly altering the natural water cycle, some of the most recognized specific impacts are:

- Decreased vegetative cover and stream shading. Damaged riparian zones provide minimal habitat and stormwater management functions.

- Increased stormwater volume and flow rate that contributes to streambank erosion, stream channelization, and flooding.

- Heat absorption by stormwater runoff that flows over impervious surfaces, resulting in increased surface water temperatures.

- Pollutant and sediment conveyance from impervious surfaces into surface water bodies, impairing water quality, fish habitat and spawning grounds.

- Low summer stream flows from lack of infiltration into groundwater recharge areas.

Multiple studies from across the nation, endorsed by the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFS), conclude that watershed degradation begins to occur when impervious surfaces exceed 10% of the area within a drainage basin. The goal of any stormwater management program aimed at addressing impacts from existing development should be to mitigate impacts to those that could be expected from a 10% impervious area coverage watershed. By instituting actions to transform a high impervious area drainage basin into a basin with only 10% ***effective*** impervious area, watershed degradation can be kept to a minimum. ***Effective*** impervious area is a term used to describe the portion of a site that discharges directly to a receiving system without any mitigation of impacts from interception, filtration, infiltration or other site practices.

So how does a local jurisdiction effectively reduce impacts to those of a 10% impervious area coverage basin? A mixture of education, technical assistance and incentive programs can make great strides to reaching this goal.

Portland's Program

Portland has had an active watershed planning and education program in place since 1991. The first step of any program to address existing development impacts should be education. Many local jurisdictions already have in place foundational components to support educational programs. The City of Portland has multiple outreach and educational programs that strive to attain the following goals:

- ***To educate residents and businesses of the City that they are part of a natural watershed***. All programs and outreach in the City are announced under their specific watershed areas – Johnson Creek, Tryon Creek, Fanno Creek, the Columbia Slough or the Willamette River.

- ***To educate residents and business about the final destination their stormwater runoff and sanitary drainage flows***. In the City approximately one third of the urban services area discharges stormwater to each of the following locations: the combined sewer to the treatment plant; to the separate sewer, which mostly drains directly to local stream systems; and into underground aquifers through public sumps and private drywells.

- ***To educate citizens and businesses about how their every day behaviors impact the environment and what changes in behavior they can make to lessen those impacts***. Usually programs include tips on changing behavior and/or onsite actions that help citizens protect clean rivers. Examples include washing cars over lawns to limit runoff of pollutants, planting trees to intercept rainfall and limit runoff, and use of native plant specific to limit horticultural chemical use and the potential for resulting polluted runoff.

- ***To create active citizenry and advocates for stormwater improvements within the City***. These advocates then take on neighborhood projects, support program implementation or help fight for program funding. Many times stormwater program advocates come from related environmental programs such as the Audubon Society, Sierra Club, and watershed councils.

Portland's educational programs include a variety of standard activities such as brochures, billing inserts, and speakers bureaus, as well as a few unique programs. Many of Portland's programs are developed and implemented in partnership with other local agencies, such as:

Environmental Services Educational Program – The City has two staff people dedicated to presenting programs for Portland school students K-12. Their curriculum includes education to support the goals above through humorous and entertaining assembly programs and classroom presentations. These educators also partner with schools to have students implement hands-on activities such as tree planting, stormwater management facility construction, or monitoring projects on or near school grounds. This program is funded through stormwater utility fees and reaches approximately 27,000 students every year.

Regional Coalition for Clean Rivers and Streams – This regional awareness programs strives to present basic messages in the tri-county area in Portland. Working with nine other local stormwater agencies, the program runs multi-media campaigns throughout the region encouraging all regional citizens not to pollute. This program is funded through stormwater utility fees and reaches 1.4 million people a year.

Naturescaping for Clean Rivers -This program was developed and is implemented by the City of Portland and the East Multnomah Soil and Water Conservation District. Targeting lawn and yard water, pesticide and fertilizer use, this program offers free workshops for local residents about the benefits and ease of using native plants in their landscape. What is especially unique about this program is the advice of a landscape architect in addressing specific property design questions. This program is funded through stormwater utility fees and reaches around 400 people a year.

Most local jurisdictions know that more than education is needed to motivate people to make behavior changes. What else is needed to motivate people to change? Primarily two things – giving citizens enough information to know what to do and making doing the right thing easy and/or financially beneficial.

Explaining What to Do – Technical Assistance

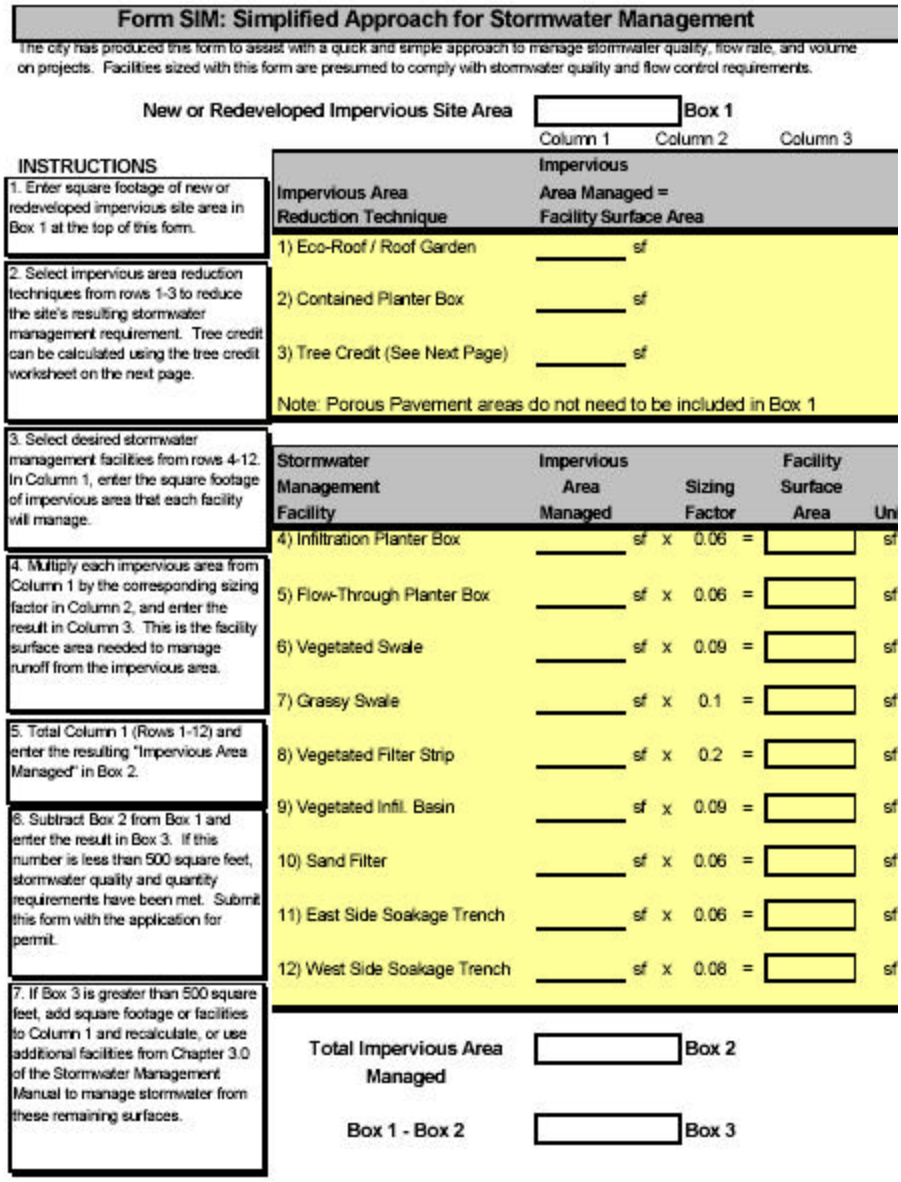
Portland has a complex menu of options on what we want people to do to lessen their impacts on local watersheds. Most actions fall into two broad categories – changing behaviors, like driving a car less, and retrofitting a site for onsite stormwater management, through planting a tree or disconnecting downspouts. Usually the behavior changes that the City promotes to lessen impacts on the local watershed also meet objectives of other programs. For instance, driving your car less reduces the amount of oil drips, car exhaust deposits, brake and tire wear particulates that end up on street surfaces, and are ultimately discharged to local waterways during storms. Having fewer cars on the road can also help limit air pollution and congestion on local roadways. Most suggested behavioral changes either limit the amount of pollution or the total volume and/or flow rate of stormwater runoff. Water quality related actions primarily focus on preventing or limiting pollution coming in contact with stormwater runoff. Volume control actions focus on infiltrating stormwater onsite or otherwise mimicking the natural flow regime for the watershed area. Because behavior changes that reduce volume or pollutants in stormwater have multiple benefits, there are great opportunities to partner with other agency programs on these multi-objective pollution prevention messages. BES looks to our educational programs to suggest behavior changes and make referrals to other agency programs for specific implementation details.

Onsite stormwater management changes are a bit more complex. It can be very difficult to present solutions in a way that can convince the average person to institute change. Many local programs simply suggest a concept or idea but fail to provide enough implementation information to make a site retrofit possible. For

example, the simplest stormwater retrofit programs (including Portland's) suggest that people "just plant a tree." Seems simple enough, but what type of tree should they plant and where? Many city codes dictate the "what" and "where" of an action. Property owners may be unaware of these regulations or have troublesome site-specific constraints that seem to be barriers to implementing retrofits. Most citizens, whether at their home or business, need additional help in mitigating impacts or changing behaviors. Ideally, there would be a city staff person available to answer any request at any time and assist owners through every step of the retrofit process. Yet, realistically, face-to-face assistance is not usually possible due to limited staff and financial resources. So we look to surrogates – whether through detailed instruction materials, in-depth workshops or short onsite visits.

One of the best places to look for detailed guidance on site retrofits is the new and redevelopment stormwater facility requirements manual. Even though existing development is not likely to be required to retrofit, they should still strive to manage stormwater to the same level as new and redeveloping properties. In reality, specific site constraints usually limit the extent of area available for retrofits, thus limiting the extent of onsite stormwater management.

Portland's Stormwater Management Manual (SWMM) provides a great deal of guidance on facility selection, facility sizing, plant selection, and maintenance activities. There are a number of City programs encouraging on-site retrofits that make great use of information in the SWMM. One particular element of the SWMM that is especially useful is the sizing form. During the last 2 years, the SWMM has undergone its second revision with the specific goal of making stormwater facility design as easy as possible. One element of that effort was the creating of a sizing matrix for simple facility design. The matrix – SIM form (Figure No. 2) – from this new development manual can be used as a great guidance document for sizing retrofit facilities for existing development. The SWMM is available at www.cleanriverspdx.org/tech_resources/2002_swmm.htm in its entirety.



Form SIM: Simplified Approach for Stormwater Management

The city has produced this form to assist with a quick and simple approach to manage stormwater quality, flow rate, and volume on projects. Facilities sized with this form are presumed to comply with stormwater quality and flow control requirements.

New or Redeveloped Impervious Site Area ____ Box 1

INSTRUCTIONS

1. Enter square footage of new or redeveloped impervious site area in Box 1 at the top of this form.
2. Select impervious area reduction techniques from rows 1-3 to reduce the site's resulting stormwater management requirement. Tree credit can be calculated using the tree credit worksheet on the next page.
3. Select desired stormwater management facilities from rows 4-12. In Column 1, enter the square footage of impervious area that each facility will manage.
4. Multiply each impervious area from Column 1 by the corresponding sizing factor in Column 2, and enter the result in Column 3. This is the facility surface area needed to manage runoff from the impervious area.
5. Total Column 1 (Rows 1-12) and enter the resulting "Impervious Area Managed" in Box 2.
6. Subtract Box 2 from Box 1 and enter the result in Box 3. If this number is less than 500 square feet, stormwater quality and quantity requirements have been met. Submit this form with the application for permit.
7. If Box 3 is greater than 500 square feet, add square footage or facilities to Column 1 and recalculate, or use additional facilities from Chapter 3.0 of the Stormwater Management Manual to manage stormwater from these remaining surfaces.

Impervious Area Reduction Technique	Column 1: Impervious Area Managed = Facility Surface Area
1) Eco-Roof / Roof Garden	____ sf
2) Contained Planter Box	____ sf
3) Tree Credit (See Next Page)	____ sf

Note: Porous Pavement areas do not need to be included in Box 1

Stormwater Management Facility	Impervious Area Managed		Sizing Factor		Facility Surface Area	Un
4) Infiltration Planter Box	____ sf	x	0.06	=		sf
5) Flow-Through Planter Box	____ sf	x	0.06	=		sf
6) Vegetated Swale	____ sf	x	0.09	=		sf
7) Grassy Swale	____ sf	x	0.1	=		sf
8) Vegetated Filter Strip	____ sf	x	0.2	=		sf
9) Vegetated Infil. Basin	____ sf	x	0.09	=		sf
10) Sand Filter	____ sf	x	0.06	=		sf
11) East Side Soakage Trench	____ sf	x	0.06	=		sf
12) West Side Soakage Trench	____ sf	x	0.08	=		sf

Total Impervious Area Managed ____ Box 2

Box 1 - Box 2 ____ Box 3

(Figure No. 2) Simplified Sizing Form from the 2002 Revision of the City of Portland Stormwater Management Manual.

This sizing form is unique because it incorporates not only sizing for water quality treatment but also sizing for flow control and detention as well. When seeking to retrofit existing development – guidance pieces from your new and redevelopment stormwater facility requirements manual can be very useful.

Portland has a number of programs geared toward assisting property owners to retrofit their sites to do onsite stormwater management. The majority of homes in Portland are currently piped into a combined or separate storm sewer. Onsite stormwater management facilities can help mitigate a site's effective impervious area and better mimic the natural hydrologic water cycle. Here's a highlight of some of Portland's most successful programs:

Downspout Disconnection (for residential properties) – Driven by the need to remove water from the combined sewer system to reduce overflows, in 1996 the City of Portland created the Downspout

Disconnection Program. This program targets properties in north, northeast and southeast Portland to disconnect roof downspouts onto lawns and flowerbeds. Property owners may also use onsite stormwater management facilities such as drywells and soakage trenches. This program is very unique in its approach. BES developed an interagency agreement with the City's Plumbing division to work directly with homeowners to disconnect downspouts without the homeowner having to get a plumbing permit for the alterations to their building's drainage system. BES staff developed safety criteria for allowable disconnections and set up a monitoring and inspection program to assure disconnections were completed safely. To implement, a target area of Combined Sewer Overflow (CSO) basins is selected and Disconnection Program staff go to work. An aggressive marketing and door-to-door canvassing campaign begins, to get voluntary agreement from property owners to complete the disconnection. Owners then elect to complete the disconnection themselves and receive a $53 per downspout incentive, or to have the City complete the disconnection for them free of charge. The City disconnections are completed either by volunteer groups (such as scouting troops, neighborhood groups, and students) or by emerging or minority small business contractors. Volunteer groups receive a stipend for each downspout they disconnect. Contractors are chosen through a City bid process. The City then inspects the work of the volunteers, City contractors, homeowner or plumber the homeowner may have hired, to assure disconnections are made safely. If the goal for the target amount of roof area removed is not met in a basin, a mandatory version of the program can be implemented. Other stormwater management messages are delivered under this program – such as planting trees for homeowners who have disconnected. The City has disconnected downspouts at almost 17,000 homes over the last six and a half years, and has collected data on prior disconnections at an additional 20,000 homes. The program is funded primarily by a mixture of capital and operating funds due to this ability to remove enough stormwater from the CSO system, that collection pipes may be able to be downsized providing significant pipe construction cost savings.

(Figure No. 3) Typical Residential Downspout Disconnection

Sustainable Site Development – This program grew from the early pilot project efforts to comply with the NPDES Municipal Stormwater Permit. The program offers technical assistance and design guidance for retrofit and developing properties. This free assistance might sway a property owner to use a swale instead of a pipe to convey parking lot runoff. City staff usually makes the initial contact from a referral of the watershed planning staff or through a land use or building plan review. This program has had some good initial success due to early contact and the ability to provide some design details to developers. The program primarily involves investment of staff time only and supports approximately 20 projects a year.

Stewardship Program – This is a joint program of the City of Portland, Portland State University and Americorps program. The Stewardship program staff members assist individual property owners with revegetation and onsite stormwater management projects. Students assist property owners in developing site designs, identifying and applying for appropriate local, state and federal permits, and identifying volunteers or other resources to implement the project. Students are assigned to specific watershed programs within the City and often coordinate and complete projects with local watershed councils. Stewardship Program staff and grants are funded through stormwater utility fees and work with about 10 projects per year.

Providing Motivation – Recognition and Incentives

Although we have taught the citizens of Portland about their impacts on local watershed and given them some guidance and technical assistance on how to change behavior and retrofit their properties, most people still need more motivation to make a change. Individual motivations can be varied across a broad spectrum – but two common motivations are recognition and money. The City has developed a number of programs that rely on recognition and/or other incentives to drive change in our citizenry. Here are some program highlights:

Ecological Business Program – Interviews of local NE Portland Businesses in 1995 demonstrated a desire of business owners not to be characterized as the "environmental bad guys." Many business owners strive to do the most environmentally friendly thing, and the number of bad actors from an environmental standpoint is usually a small percentage of the businesses out there. So, rather than relying on the few business horror stories as the only case studies reported by the media, businesses asked the City to develop a program to highlight "environmentally friendly" businesses. The City took this request to heart. The City already had a partnership with six other local and state agencies to produce educational materials in a coordinated matter. The partnership, called the Pollution Prevention Outreach (P2O) Team, already produced successful used oil disposal and paint waste outreach materials that were helpful to businesses. So the P2O team developed the Ecological Business Program. "Eco-biz" was the first multi-media and multi-jurisdictional business recognition program in the nation. Local regulatory staff with air, water quality, wastewater, hazardous waste, solid waste, stormwater, energy and water-use backgrounds developed a certification and recognition program to highlight environmentally friendly businesses in the Portland region. The program is business sector-based. Eco-biz started with automotive service shops and is now working on a Landscape Contractor program. Along the way, Dental and Print Shop programs similar to Eco-biz have been developed in the region. Eco-biz partners work with local business trade groups to develop environmentally friendly best management practices, a program certification checklist and recognition materials for program participants. After a certification visit, participating shops receive a shop display package, press coverage, listing on the program web site (www.ecobiz.org), and general promotion on the radio and at public events. This program is funded by several agencies through grants, agency staff time and minimal advertising and printing budgets (< $10,000). Over 40 automotive shops are certified

since the program launched in September of 1999. Those shops on average have implemented 89% of all the recommended environmental actions – including stormwater improvements from redirecting wash waters away from storm systems and providing secondary containment for liquid storage and working areas. An evaluation report completed in September of 2000 found the average ecobiz shop generated 5 cubic feet less cardboard and paper, 2.5 cubic feet less of metal scrap and 4 less batteries to the solid waste system per month.

(Figure No. 4) Ecological Business Automotive Services Program Logo

Stewardship Grants – One aspect of the Stewardship Program is the Stewardship Grants Program. BES funds a small number of low cost grants (<$5,000) for community-based projects in the City. Grants have been used to pay for streambank restoration projects, downspout disconnections, stormwater facility retrofits and naturescaping. Applicants can be either public or private entities and a number of the grants have gone to school projects – including one native plant greenhouse. Grants are awarded every May and must be completed by the following summer. Applications stressing partnership with other community groups or showing inclusion of other investment or funding sources are prioritized for grant award. In the grant year of 2001, $46,374 was awarded yielding $242,683 worth of project investment. Projects resulted in planting over 10,000 trees and restoration of over 8,800 lineal feet of streambank. Projects are recognized each year in an annual report prepared by BES. Grants are funded by Stormwater utility fees.

Clean River Incentive and Discount Program (CRID) – This incentive program will provide financial incentives to property owners who manage stormwater on their site. The program is currently delayed due to the installation of a failing billing system. Once the billing system is repaired, the program should be instituted. The main goal of the CRID is to drive property owners to retrofit through provision of a discount on their monthly stormwater utility charge. The CRID was developed in the summer and fall of 2000 as a method of rate reform for the citizens of Portland. City sewer rates are rising at approximately 9% a year to fund the billion-dollar CSO program. The CRID actually alters the breakdown of the stormwater utility rate. Previously, properties paid one rate based on the amount of impervious surface on their property. In January 2001, the Portland City Council instituted a two-part rate –35% of the charge for providing drainage services to the property and 65% of the charge to provide drainage services to the public right of way that served the property. Not only did the charge breakdown reinforce that street drainage is an issue the City must deal with, it also allowed a portion of the rate to be discounted for properties providing

onsite stormwater management. So with 35% of the stormwater rate up for a potential discount, some properties could be incented to make retrofit changes. The CRID has a simplified discount program for residential properties based on volume control, and a more complex commercial property program that requires water quality and flow control for the full discount. Surface vegetated facilities were ranked higher than subsurface facilities for the eligible portion of the discount. BES was working on a prorated discount funding program to help pay for the initial capital outlay when the City's new water and sewer billing system started to fail.

Conclusions

The City of Portland has successfully developed a number of educational, technical assistance, recognition and incentive based programs to encourage our citizens to help limit their impacts on local watersheds. While these efforts may be noteworthy, they are not sufficient to address existing development watershed impacts all by themselves. Some tasks for mitigating urban area impacts are the City's alone. So the City will continue to build regional stormwater management facilities, improve our operations and maintenance practices on City streets and sewers and protect and enhance riparian resource areas. But we will be looking to develop additional programs to enlist the aid of Portland's citizens to limit our impacts on local watersheds. While new programs may have staffing and other limited resources available for implementation, there will be no lack in drive from City staff and our local environmental advocates to reach for that 10% effective impervious area target.

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